

PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Wear Plate Assembly for Jaw Crusher

We, SMITH ENGINEERING WORKS, of 532, East Capitol Drive, Milwaukee, Wisconsin, United States of America, a Corporation of the State of Wisconsin, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The present invention relates generally to improvements in the construction of jaw-type crushers, its primary object being to provide such a machine in which the crushing elements are most effectively protected against undesirable distortion, tending to reduce their effectiveness, and in which the parts subjected to maximum wear are readily replaceable.

15 In crushers for hard and relatively abrasive substances, such as rock and ore, those surfaces which are directly exposed to the crushing action are usually protected against rapid wear by so-called liners formed of wear-resistant material such as manganese steel. While such material is capable of effectively resisting abrasive action, it is quite malleable and stretches when subjected to repeated impact and peening for any great length of time. In relatively small machines whose directly exposed crushing surfaces are not 20 extensive, are the liners merely confined between stops at their upper and lower edges, but such slight stretching of these elements as occurs has little effect upon the crushing action and all that is required is replacement 25 of the liners when excessively worn.

30 However, in large jaw-type crushers with extensive protective liners, the stretching or elongation of these elements causes them to swell and bulge away from their supports if confined by stops at their opposite edges. When such bulging occurs, the central parts of the liners 35 are alternately pressed inwardly and allowed to expand outwardly as the crushing members approach and recede from one another, thus not only reducing the effectiveness of the

crushing action and wasting power, but also tending to cause breakage of the liners due to repeated flexure. Then too, in such jaw crushers, the maximum wear usually takes place near the inlet and outlet of the crushing chamber, so that if the liner of each crushing member is formed of a single piece of manganese steel, replacement of the entire element often entails considerable unnecessary expense due to wastage of still usable material.

40 It is therefore a more specific object of the present invention to provide an improved protective liner or die assemblage especially adapted for use in large jaw-type crushers, and which obviates all of the abovementioned objectionable features.

45 Another important object of this invention is to provide an improved mounting for the protective liners of cooperating relatively movable crushing members, whereby objectionable bulging or other distortion of such liners is effectively eliminated.

50 A further important object of the invention is to provide an improved protective liner or die assemblage for jaw crushers, which most effectively compensates for spreading of such elements under the impact and peening action to which they are subjected.

55 Still another important object of this invention is to provide, for the cooperating crushing jaws of large jaw crushers, improved protective liners which can conveniently be renewed either in their entirety, or only as regards excessively worn portions thereof, whichever may be desirable.

60 An additional important object of the invention is to provide an improved jaw crusher of enormous capacity and of great strength and durability which can be effectively operated with minimum loss of time due to necessary repairs.

65 These and other more specific objects and advantages of the present invention will be apparent from the following detailed description.

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According to the present invention, in a crusher having a pair of relatively movable jaws mounted on a frame and cooperating therewith to form a crushing chamber, the side of each jaw facing said chamber is provided with a sectional protective liner which comprises a medial die anchored to its supporting jaw and adjoined end dies interlocked with the adjacent parts of said medial die but left free to expand and contract in relation thereto.

A clear conception of the several features constituting the present improvements and of the construction and operation of a typical jaw crusher embodying the invention, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a central vertical section through a jaw crusher equipped with the improved liner dies for the cooperating crushing members, the section having been taken substantially along the line 1—1 of Fig. 2;

Fig. 2 is a fragmentary top view of the jaw crusher illustrated in section in Fig. 1, showing approximately one half of the machine;

Fig. 3 is an enlarged side view of the medial liner die of the movable jaw member of the same crusher;

Fig. 4 is a similarly enlarged side view of the lower liner die of the movable jaw member;

Fig. 5 is a likewise enlarged side view of the medial liner die or wedge of the stationary jaw member of the crusher;

Fig. 6 is a similarly enlarged side view of the lower liner die of the stationary jaw member;

Fig. 7 is a likewise enlarged top view of a fragment of the fixed jaw liner die wedge shown in Fig. 5;

Fig. 8 is a similarly enlarged top view of a fragment of the fixed jaw liner die shown in Fig. 6; and

Fig. 9 is a likewise enlarged top view of a fragment of the movable jaw liner die shown in Fig. 3.

While the invention has been illustrated and described herein as having been applied to a jaw crusher of the eccentric and toggle actuated type having only one movable crushing jaw coacting with a single stationary jaw, it is not intended to limit the use of the improved liner dies and their mountings to such crushing units; and it is also contemplated that specific descriptive terms employed herein be given the broadest possible interpretation consistent with the disclosure.

Referring to the drawings, the improved jaw crusher illustrated therein, comprises in general a rectangular main frame whose upper and lower sections 11, 12 respectively provide inlet and discharge openings 13, 14 for the material to be treated; an upright stationary

crushing member or jaw 15 spanning one side of the main frame and being provided with a wedge-section medial liner die 16 which cooperates with upper and lower liner dies 17, 18 to oppose an inclined movable crushing member or jaw 19 swingably suspended at its upper end from an eccentric drive shaft 20 journalled in bearings 21 on the upper frame section 11. This jaw, whose lower end is adapted to rock upon a toggle link 22 interposed between it and a bracket 23 on the lower frame section 12, also spans the main frame and is provided with a medial liner die 24 cooperating with upper and lower dies 25, 26 to form a crushing surface facing the fixed jaw dies 16, 17, 18. A downwardly-convergent crushing chamber 27 is defined by the two die assemblages above-described and liner die plates 28, 29 secured to the opposite sides of the frame sections 11, 12.

The main frame, including the stationary jaw 15 may be formed of heavy ordinary steel plates united as by welding, whilst the oscillatory or movable jaw 19, toggle link 22 and bracket 23 are conveniently constructed of durable steel castings. The liner dies for the crushing jaws 15, 19 and for the side walls of the main frame are, however, preferably formed of wear-resisting material such as manganese steel; which material, being relatively malleable, tends to stretch or expand to a considerable extent when subjected to impact and severe pressure so that it is very desirable, especially in large crushers with capacious crushing chambers 27, to provide means adapted automatically to compensate for such stretching or expansion of the dies. The upper and lower frame sections may be firmly but detachably united, as by bolts 31 coacting with rigid flanges 32 thereof, and since the side liner plates 28, 29 of the frame are not subjected to severe expansive stresses they may be detachably secured to the adjacent frame side walls by means of ordinary bolts 33 in a customary manner.

The liner dies 16, 17, 18 for the fixed jaw 15 and the liner dies 24, 25, 26 for the movable jaw 19 may have corrugated crushing surfaces exposed directly to and extending downwardly along the crushing chamber 27 as indicated in the drawings, the upper and lower liner dies in each case being interchangeably similar and normally held in place by the medial die.

The medial fixed jaw liner die 16 is formed as illustrated in Figs. 1, 5 and 7 with spaced central fins 35 extending into recesses in the fixed jaw 15 and forming a horizontal groove which coacts with a key 36 interposed within aligned recesses in the frame sections 11, 12. This die is wedge shaped as shown and is provided with parallel upper and lower outwardly directed tongues and adjoining grooves 37, 38 respectively. The associated upper and lower liner dies 17, 18 are each provided with

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5 rear reaction pads 39 and with tongues and adjoining grooves 40 adapted to interlock with the adjacent tongues and grooves 37, 38 of the interposed wedge die 16, which latter may be clamped to the jaw 15 by a series of immovable bolts 41, whilst the liner dies 17, 18 are adapted to be likewise clamped by deflectable bolts 42 passing through clearance holes 43 in the frame sections 11, 12 and in the adjacent portions of the jaw 15. The arrangement is such that the medial wedge die 16 remains fixed during normal operation of the crusher, whereas when the liner dies 17, 18 stretch and become elongated in use their expansion away from the die 16 is compensated for by the pads 39 sliding along the fixed jaw 15 and bending or flexure of the bolts 42.

10 The medial movable jaw liner die 24 is formed, as illustrated in Figs. 1, 3 and 9, with a rear central positioning pad 45 engageable with a central recess 46 in the movable jaw 19, and with a series of laterally spaced pads 47 across its mid-portion, all these pads being clamped to the jaw 19 by bolts 48 passing through the central part of the die. The upper and lower ends of the latter are provided with rear recesses 49 which slidably engage projections 50 formed integral with the jaw 19, and these ends also have tongues and adjoining grooves 51 formed thereon.

15 The upper and lower liner dies 25, 26 of the movable jaw 19 are each provided with rear reaction pads 52 at their outer ends and with rear recesses 53 adapted slidably to engage the jaw projections 50 at their inner ends, which latter are also provided with tongues and adjoining grooves 54 for interlocking with the tongues and grooves 51 of the medial die 24. The dies 25, 26 are normally held in place by bolts 55 inclined to their crushing surfaces as shown in Fig. 1, such clamping bolts being deflectable when the liner dies 24, 25, 26 stretch or expand away from the central clamping bolts 48.

20 The remainder of the jaw crusher is of relatively well known construction, the eccentric shaft 20 which swingably suspends the movable jaw 19, being provided with flywheel pulleys 57 at one or each end thereof. The lower swindling end of the movable jaw 15 is normally held in engagement with the toggle link 22 by means of one or more retainer rods 58 and compression springs 59, and the toggle reaction bracket 23 is adjustably supported from and secured to the rear portion of the main frame 11 by means of clamping bolts 60 as illustrated in Fig. 1. When the various parts of the jaw crusher have been constructed and assembled as hereinabove described, and properly adjusted for normal operation, the driving shaft 20 may be rotated to cause the movable jaw 19 to oscillate or swing relative to the fixed jaw 15, the material to be crushed being then fed through the upper inlet opening 13, into the chamber 27, gradually reduced

25 by the interaction of the jaws 15, 19 as it gravitates through such chamber to the lower outlet opening 14.

30 During the crushing action and the sliding of such material along the corrugated surfaces of the liner dies 16, 17, 18, 24, 25, 26 these latter are subjected to enormous impact and pressure causing them to stretch or expand primarily in the direction of advancement of the material. Since the mid-portions of the medial liner dies 16, 24 are firmly clamped to the jaws 15, 19 by the heavy bolts 41, 48 respectively any expansion which occurs in these dies and in the upper and lower liner dies 17, 18, 25, 26 which are firmly connected with the opposite upper and lower ends of the dies 16, 24 by the coacting tongues and grooves 37, 38, 40, 51, 54 is constrained to take place in a direction away from the central anchoring bolts 41, 48. In the case of the relatively narrow wedge die 16 such expansion is negligible, but in the wider medial die 24 the expansion takes place along the projections 50 of the jaw 19, and the pads 39, 52 and projections 50 also permit the upper and lower end dies 17, 18, 25, 26 to expand and slide along their respective crushing jaws 15, 19, the deflectable bolts 42, 55 functioning to permit such stretching or expansion of these end dies away from their retaining medial dies 16, 24, and thus effectively compensating for expansion or contraction of all the protective elements.

35 From the foregoing detailed description of the construction and functioning of the improved crusher, it will be apparent that the present invention in fact automatically compensates for any distortion of the jaw liner dies whilst positively eliminating any bulging tendency of these dies which would reduce the crushing efficiency. The key 36 besides anchoring the wedge die 16 in place, also serves to facilitate proper assembly of the main frame sections 11, 12, whilst the formation and relative disposition of the liner clamping bolts 41, 42, 48, 55 permits free expansion and contraction of the dies.

40 Since the wear on the crushing surfaces of the liner dies is not always uniform, it may sometimes happen that only certain dies require replacement and the present improved sectional formation of these dies enables such partial renewal of the liners. The upper and lower dies 25, 26 of the movable jaw 19 may obviously be removed and replaced by merely manipulating the bolts 55 and without disturbing the medial liner die 24, the medial and upper and lower dies 16, 17, 18 of the fixed jaw 15 being also readily removable and replaceable by manipulating the bolts 41, 42. The interlocking tongues and grooves 37, 38, 40, 51, 54 may be readily ground to insure proper coaction, and provide firm connections between the adjacent liner die sections. The side liners 28, 29 being least subject to

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wear, require renewal only at relatively long intervals.

5 While the improved liner die assemblage is primarily intended for use in large machines having extensive crushing surfaces, it may also be advantageously applied to other sizes of jaw crusher, experience showing that it considerably increases the crushing efficiency while also greatly facilitating the making of 10 necessary repairs.

15 It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise functioning of the jaw crusher liner assemblage herein shown and described, for various modifications within the scope of the appended 20 claims may occur to persons skilled in the art.

WHAT WE CLAIM IS:—

25 1. A crusher having a pair of relatively movable jaws mounted on a frame and cooperating therewith to form a crushing chamber, characterised in that the side of each jaw facing said chamber is provided with a sectional protective liner which comprises a medial die anchored to its supporting jaw and adjoined end dies interlocked with the adjacent parts of said medial die but left free to expand and contract in relation thereto.

2. A crusher according to Claim 1, further characterised in that the crushing chamber is 30 upright and has an upper inlet and a lower outlet.

3. A crusher according to Claim 1 or Claim 2, further characterised in that the medial die is anchored to its carrying jaw approximately midway between the opposite ends of the latter, and/or between the inlet and outlet of the crushing chamber. 35

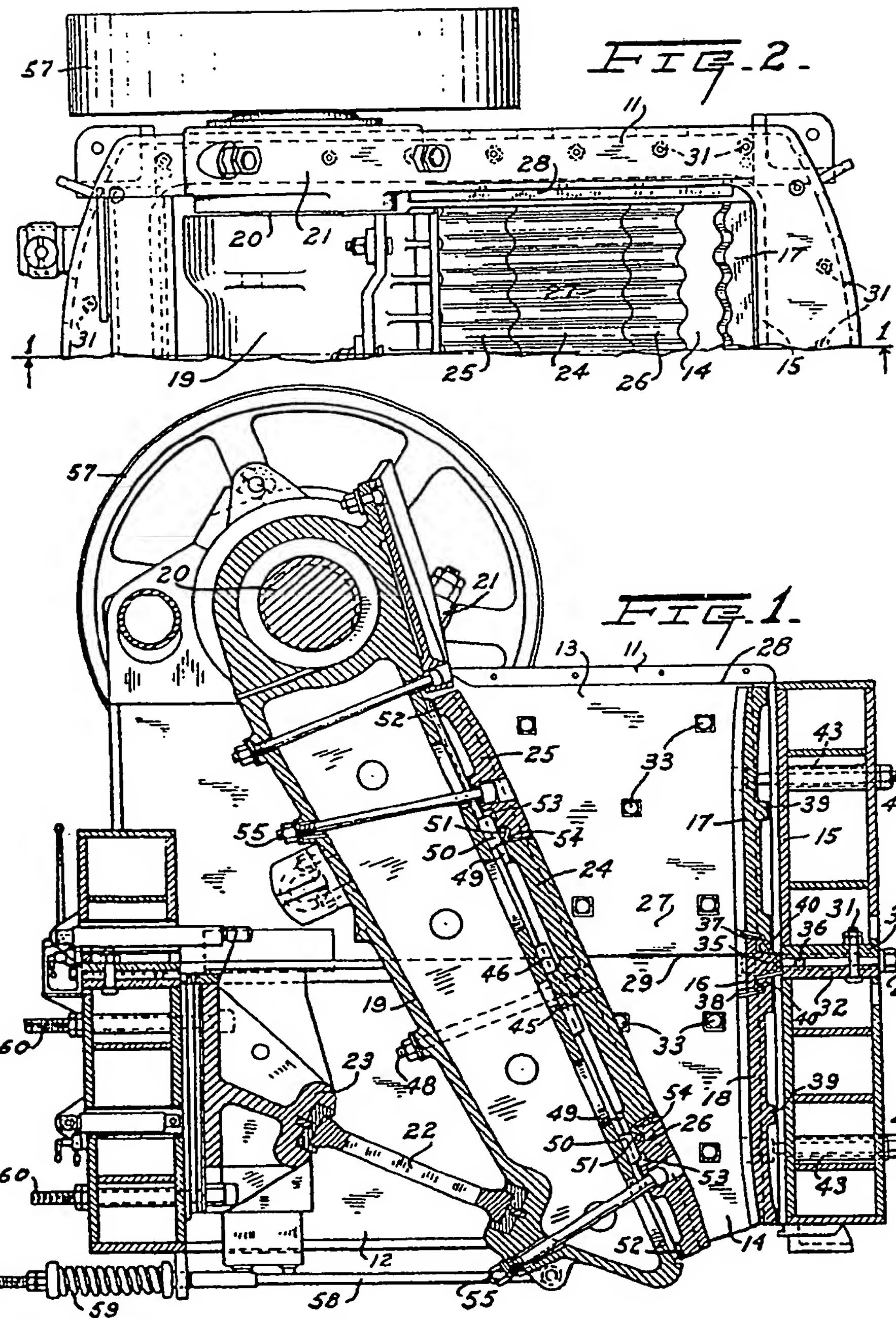
4. A crusher according to any one of the preceding claims further characterised in that the adjoined ends of the medial and end dies are interlocked by tongue and groove connections. 40

5. A crusher according to any one of the preceding claims further characterised in that the end dies are secured to their supporting jaws by laterally deflectable bolts arranged to permit free expansion and contraction of these dies relative to the interposed medial dies. 45

6. A crusher substantially as described with reference to, and as shown in the accompanying drawings. 50

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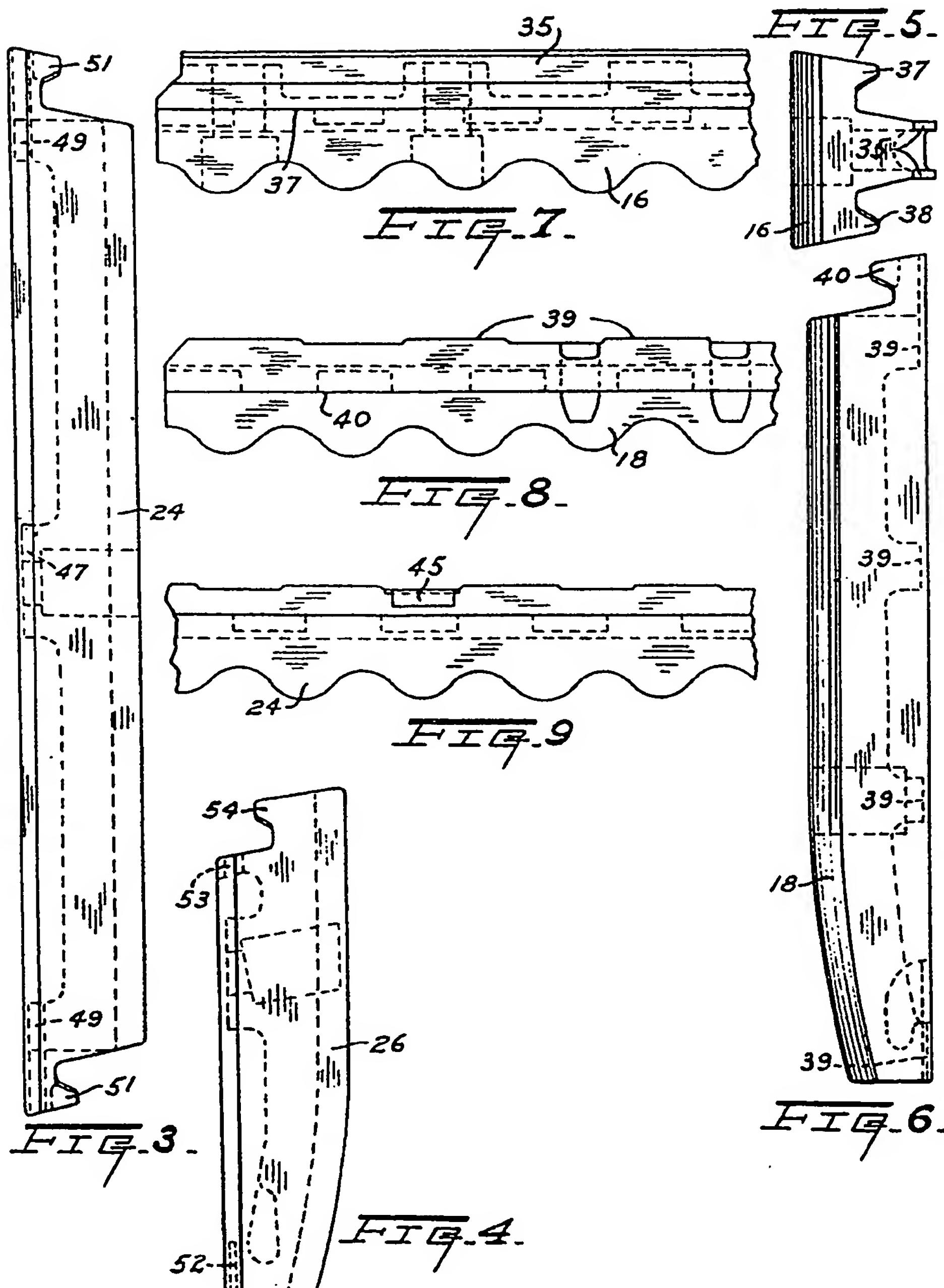


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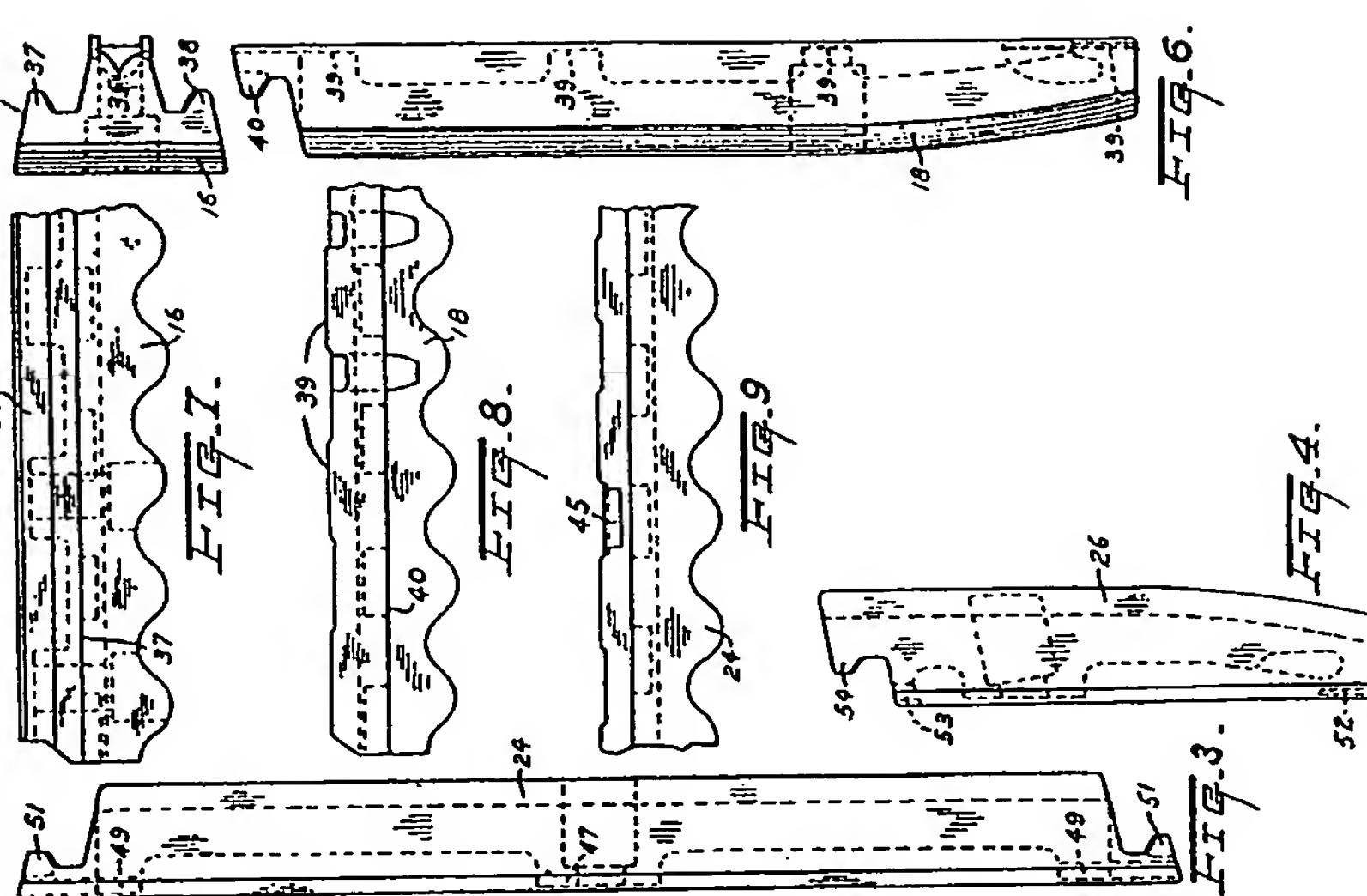
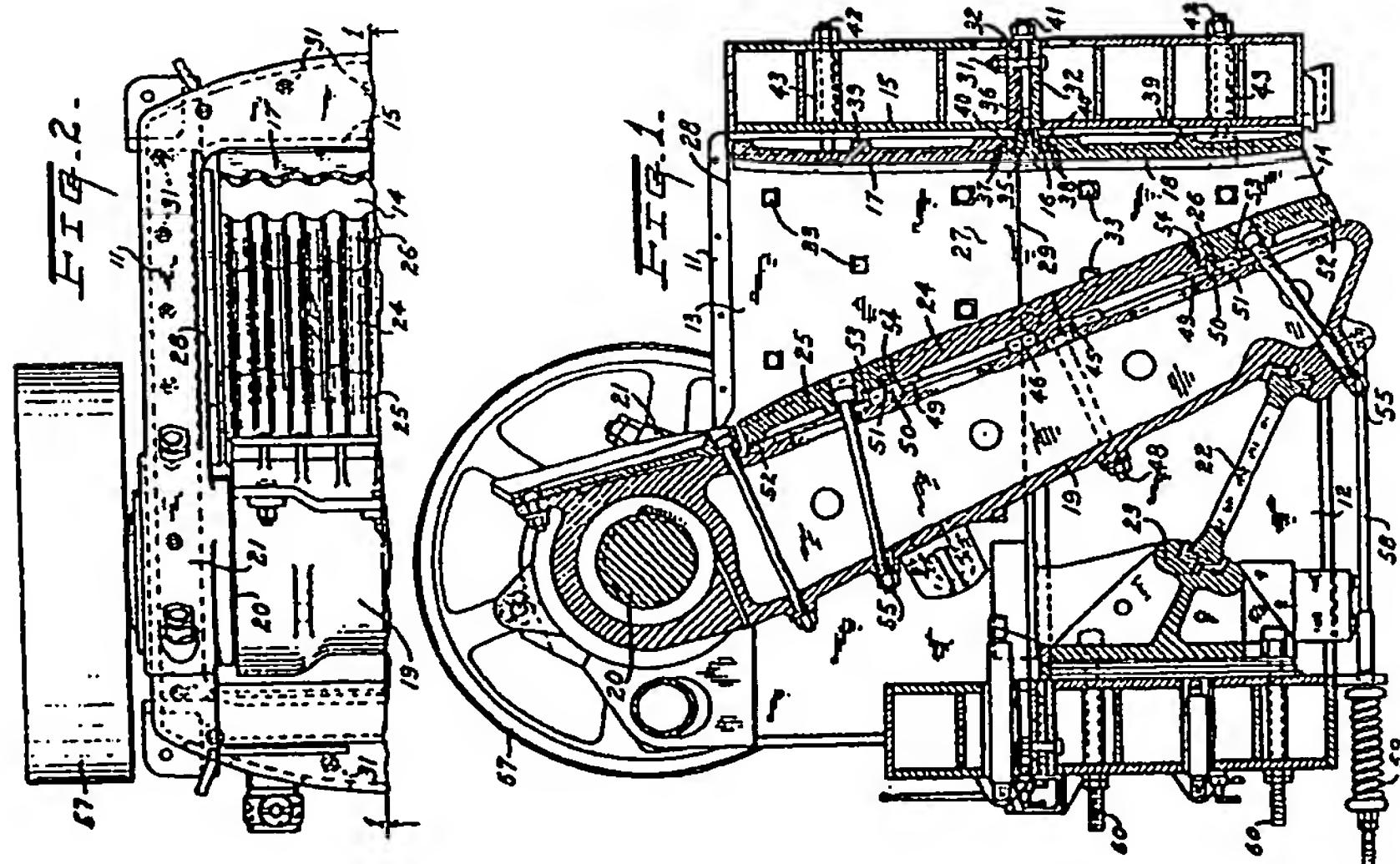
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